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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/682,151	07/27/2001	Martin E. Kordesch	XDEV1100	5628

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EXAMINER	
BAUMEISTER, BRADLEY W	

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 11/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/682,151	KORDESCH ET AL.	
	Examiner	Art Unit	
	B. William Baumeister	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 September 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 5, 6, 8, 9, 15 and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by Morris '097. See e.g., FIG 4e wherein the first through fourth layers (using the layer-designation terminology of the product claims—not the method claims) respectively read on GaAs-based collector 204; base 206; emitter 208 and heavily doped base contact 226. Base metal electrode 228 contacts the base contact layer 226.

a. The base contact and emitter are sufficiently close in height that they may be deemed to constitute being "substantially co-planar."

b. Regarding claim 15, the base is disclosed as having a thickness of 80 nm (col. 7, TABLE 2) which is "approximately 0.1 microns" or 100 nm.

c. Also, please note that col. 6 that when the heavily-doped base contact is formed directly on the base (without an interposed wide-bandgap passivation extrinsic base layer 124) the structure still prevents metal spiking through the base layer.

3. Claims 1, 5, 6, 8, 9, 12-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Sakai et al. '871.

a. The base contact and emitter are sufficiently close in height that they may be deemed to constitute being "substantially co-planar."

b. See e.g., FIG 2 wherein Sakai discloses a GaAs-based (compound semiconductor) bipolar transistor including collector 3; base 4 (doped ~ 4e19; col. 7, TABLE 1); and emitter 5, The emitter layer is patterned to define an opening (in conjunction with base layer 4 and regrown layers 14 and 15) with a wall (the wall of the emitter which is covered by insulating layer 12). More heavily-doped (~ 1e20; col. 6, line 8) base-contact is formed in the opening. Base electrode 8 electrically contacts the base and base contact layers 4 and 16; emitter electrode electrically contacts emitter 5.

c. Regarding claim 14, first insulating layer 12 and second insulating layer 11 are formed respectively on the side and top of the emitter layers. The top surfaces of second insulating layer 11 and the metal contacts further from the substrate (base electrode 8) "lie in substantially a same plane."

d. Regarding claim 15, the base layer has a thickness of 1000 angstroms (See col. 7, TABLE 1; while the units are omitted from the table, compare col. 5, lines 2 which indicates that the units are intended to be angstroms) , or 0.1 micron.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 3, 4, 7, 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morris as applied to the claims above in view of Singh et al. '254 (previously made of record by Applicant in IDS filed 8/2/2001).

a. Morris teaches the limitations of the above, parent claims, but does not expressly disclose that the bipolar transistor's material system may be specifically composed of SiC. While the reference discloses examples of GaAs-based transistors; the invention is not limited to GaAs-based transistors. Morris specifically discloses that implementation of that invention is contemplated in GaAs families, InP families or other electronic materials families, and also in other technology-based forms and embodiments (col. 1,2 lines 35-41).

b. Singh et al. '675 teaches that SiC bipolar transistors with heavily-doped semiconductor base contact regions were conventional. It further teaches that the properties of SiC are such that bipolar transistors composed of SiC have the capability of operating at higher temperatures, power densities, speeds, power levels and under high radiation densities relative to bipolar transistors composed of GaAs, InP or Si based-systems (col. 1, lines 50- col. 2, lines 3). Singh also teaches that these properties make SiC-based BJTs desirable for various applications as high power radio frequency transmitters for radar and communications, for high power switching applications, and for high temperature operations such as get engine control (col. 2, lines 4-12).

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have substituted SiC for the GaAs-based composition of Morris' BJT because Morris expressly states that that invention may be implemented with various material systems, including but not limited to GaAs- and InP-based systems, and because Singh teaches the advantages that SiC has over GaAs- and InP-based systems for BJTs.

d. Regarding claim 7, Singh teaches that Al was conventionally used to make ohmic contact p-type SiC (col. 8, lines 30-43).

6. Claims 3, 4, 7, 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakai as applied to the claims above in view of Singh et al. '254 (previously made of record by Applicant in IDS filed 8/2/2001).

a. Sakai teaches GaAs-based compound semiconductor bipolar transistors that have improved high frequency gain relative to other prior-art GaAs-based transistors. Sakai does not disclose that other material systems may be substituted for GaAs

b. Singh et al. '675 teaches that SiC bipolar transistors with heavily-doped semiconductor base contact regions were conventional. It further teaches that the properties of SiC are such that bipolar transistors composed of SiC have the capability of operating at higher temperatures, power densities, speeds (or frequencies), power levels and under high radiation densities relative to bipolar transistors composed of GaAs, InP or Si based-systems (col. 1, lines 50- col. 2, lines 3). Singh also teaches that these properties make SiC-based BJTs desirable for various applications as high power radio frequency transmitters for radar and communications, for high power switching applications, and for high temperature operations such as get engine control (col. 2, lines 4-12).

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have substituted SiC for the GaAs-based composition of Sakai' BJT either for the reasons set forth in Singh or alternatively because SiC has a higher operating

frequency (speed) and a lower dielectric constant than GaAs (~ 6.52 vs. ~ 13.1, respectively) (resulting in a lower base-collector capacitance) thereby enabling a further increase in high frequency gain as desired by Sakai.

d. Regarding claim 7, Singh teaches that Al was conventionally used to make ohmic contact p-type SiC (col. 8, lines 30-43).

7. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over either Morris/Singh or alternatively Sagai/Singh as applied to claim 1 above, and further in view of Luo et al., "Demonstration of 4H-SiC power bipolar junction transistors," Electronic Letters, 17th August 2000, Vol. 36, No. 17, pp.1496-1497.

a. Regardless of whether Singh teaches that the Al base electrode may be formed on the heavily-doped p-SiC base contact layer specifically by sputtering, Luo teaches that sputtering metals comprising Al was a conventional way of forming base electrodes on heavily-doped p-SiC base contact regions (see page 1496, col. 2).

Response to Arguments

8. Applicant's arguments filed 9/13/04 have been fully considered but they are not persuasive. Applicant argues that the present invention is distinguishable over the prior art references in that the base contact and emitter of the present invention are co-planar, whereas those structures of the prior-art references are not co-planar.

a. First, Applicant's claims do not set forth that these layers are "co-planar." Rather, they set forth that the structures are "*substantially* co-planar."

b. Second, Applicant acknowledges that Morris expressly discloses that these layers are "quasi-coplanar." Applicant has not provided any explanation of how "substantially co-planar" is objectively, structurally distinguishable from "quasi-co-planar."

c. As such, Applicant's amendments do not overcome the rejections. According to the broadest reasonable interpretation, the prior art references' layers may be deemed to constitute being "substantially co-planar" because these two surfaces are either "quasi-coplanar" or at least more co-planar than if the surface of the base contact layer were recessed below the surface of the base layer. Arguments for any narrower interpretation of "substantially coplanar" may raise 112-2nd paragraph, indefinite issues because the claims do not set forth any objective standard for what degree of co-planarity is required for constituting "substantially co-planar," and the specification does not set forth any express definition.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to B. William Baumeister whose telephone number is (571) 272-1722. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BRADLEY BAUMEISTER
PRIMARY EXAMINER

B. William Baumeister
Primary Examiner
Art Unit 2815

November 27, 2004